CLAIMS

We claim:

1. A method for manufacture of a device for regulating the flow of electrical current, the method comprising:

providing for a semiconductor substrate;

providing for an electrically insulating layer in contact with the semiconductor substrate, the insulating layer having a dielectric constant greater than 4.0;

providing for a gate electrode in contact with at least a portion of the insulating layer; and

providing a source electrode and a drain electrode in contact with the semiconductor substrate and proximal to the gate electrode wherein at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate.

2. The method of claim 1, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

3. The method of claim 1, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

4. The method of claim 1, wherein the insulating layer is formed from a member of the group consisting of metal oxides.

5. The method of claim 1, wherein the insulating layer is formed from an oxy-nitride stack.

6. The method of claim 1, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel.

7. The method of claim 1, wherein an entire interface between at least one of the source electrode and the drain electrode and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

8. The method of claim 1, wherein dopants are introduced into the channel region.

9. The method of claim 1, wherein the insulating layer includes more than one layer.

10. The method of claim 2 or 3, wherein the insulating layer is formed from a member of the group consisting of metal oxides.

11. The method of claim 2 or 3, wherein the insulating layer is formed from an oxy-nitride stack.

12. The method of claim 10, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel, and wherein dopants are introduced into the channel region.

13. The method of claim 11, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel, and wherein dopants are introduced into the channel region.

14. The method of claim 2 or 3, wherein providing a source electrode and a drain electrode in contact with the semiconductor substrate is performed at a processing temperature of less than about 800 °C.

15. A method for manufacture of a device for regulating the flow of electrical current, the method comprising:

providing for a semiconductor substrate;

providing for an electrically insulating layer in contact with the semiconductor substrate, the insulating layer having a dielectric constant greater than 7.6;

providing for a gate electrode in contact with at least a portion of the insulating layer; and

providing a source electrode and a drain electrode in contact with the semiconductor substrate and proximal to the gate electrode wherein at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate.

16. The method of claim 15, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

17. The method of claim 15, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

18. The method of claim 15, wherein the insulating layer is formed from a member of the group consisting of metal oxides.

19. The method of claim 15, wherein the insulating layer is formed from an oxy-nitride stack.

20. The method of claim 15, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel.

21. The method of claim 15, wherein an entire interface between at least one of the source electrode and the drain electrode and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

22. The method of claim 15, wherein the insulating layer includes more than one layer.

23. The method of claim 15, wherein dopants are introduced into the channel region.

24. A method for manufacture of a device for regulating the flow of electrical current, the method comprising:

providing for a semiconductor substrate;

providing for an electrically insulating layer in contact with the semiconductor substrate, the insulating layer having a dielectric constant greater than 15;

providing for a gate electrode in contact with at least a portion of the insulating layer; and

providing a source electrode and a drain electrode in contact with the semiconductor substrate and proximal to the gate electrode wherein at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate.

25. The method of claim 24, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

26. The method of claim 24, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

27. The method of claim 24, wherein the insulating layer is formed from a member of the group consisting of metal oxides.

28. The method of claim 24, wherein the insulating layer is formed from an oxy-nitride stack.

29. The method of claim 24, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel.

30. The method of claim 24, wherein an entire interface between at least one of the source electrode and the drain electrode and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

31. The method of claim 24, wherein dopants are introduced into the channel region.

32. The method of claim 24, wherein the insulating layer includes more than one layer.

33. A method for manufacture of a device for regulating the flow of electrical current, the method comprising:

providing for a semiconductor substrate;

providing for an electrically insulating layer in contact with the semiconductor substrate, the insulating layer having a dielectric constant greater than 4.0;

providing for a gate electrode located in contact with at least a portion of the insulating layer;

exposing the semiconductor substrate on one or more areas proximal to the gate electrode;

providing for a thin film of metal on at least a portion of the exposed semiconductor substrate; and

reacting the metal with the exposed semiconductor substrate such that a Schottky or Schottky-like source electrode and drain electrode are formed on the semiconductor substrate.

34. The method of claim 33, wherein the gate electrode is provided by:

depositing a thin conducting film on the insulating layer;

patterning and etching the conducting film to form a gate electrode; and

forming one or more thin insulating layers on one or more sidewalls of the gate electrode.

35. The method of claim 33, further comprising removing metal not reacted during the reacting process.

36. The method of claim 33, wherein the reacting comprises thermal annealing.

37. The method of claim 33, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

38. The method of claim 33, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

39. The method of claim 33, wherein the insulating layer is formed from a member of the group consisting of metal oxides.

40. The method of claim 33, wherein the insulating layer is formed from an oxy-nitride stack.

41. The method of claim 33, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel.

42. The method of claim 33, wherein an entire interface between at least one of the source electrode and the drain electrode and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

43. The method of claim 33, wherein dopants are introduced into the channel region.

44. A method for manufacture of a device for regulating the flow of electrical current, the method comprising:

providing for a semiconductor substrate;

providing for an electrically insulating layer in contact with the semiconductor substrate, the insulating layer having a dielectric constant greater than 7.6;

providing for a gate electrode located in contact with at least a portion of the insulating layer;

exposing the semiconductor substrate on one or more areas proximal to the gate electrode;

providing for a thin film of metal on at least a portion of the exposed semiconductor substrate; and

reacting the metal with the exposed semiconductor substrate such that a Schottky or Schottky-like source electrode and drain electrode are formed on the semiconductor substrate.

45. The method of claim 44, wherein the gate electrode is provided by:

depositing a thin conducting film on the insulating layer;

patterning and etching the conducting film to form a gate electrode; and

forming one or more thin insulating layers on one or more sidewalls of the gate electrode.

46. The method of claim 44, further comprising removing metal not reacted during the reacting process.

47. The method of claim 44, wherein the reacting comprises thermal annealing.

48. The method of claim 44, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

49. The method of claim 44, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

50. The method of claim 44, wherein the insulating layer is formed from a member of the group consisting of metal oxides.

51. The method of claim 44, wherein the insulating layer is formed from an oxy-nitride stack.

52. The method of claim 44, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel.

53. The method of claim 44, wherein an entire interface between at least one of the source electrode and the drain electrode and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

54. The method of claim 44, wherein dopants are introduced into the channel region.

55. A method for manufacture of a device for regulating the flow of electrical current, the method comprising:

providing for a semiconductor substrate;

providing for an electrically insulating layer in contact with the semiconductor substrate, the insulating layer having a dielectric constant greater than 15;

providing for a gate electrode located in contact with at least a portion of the insulating layer;

exposing the semiconductor substrate on one or more areas proximal to the gate electrode;

providing for a thin film of metal on at least a portion of the exposed semiconductor substrate; and

reacting the metal with the exposed semiconductor substrate such that a Schottky or Schottky-like source electrode and drain electrode are formed on the semiconductor substrate.

56. The method of claim 55, wherein the gate electrode is provided by:

depositing a thin conducting film on the insulating layer;

patterning and etching the conducting film to form a gate electrode; and

forming one or more thin insulating layers on one or more sidewalls of the gate electrode.

57. The method of claim 55, further comprising removing metal not reacted during the reacting process.

58. The method of claim 55, wherein the reacting comprises thermal annealing.

59. The method of claim 55, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

60. The method of claim 55, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

61. The method of claim 55, wherein the insulating layer is formed from a member of the group consisting of metal oxides.

62. The method of claim 55, wherein the insulating layer is formed from an oxy-nitride stack.

63. The method of claim 55, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel.

64. The method of claim 55, wherein an entire interface between at least one of the source electrode and the drain electrode and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

65. The method of claim 55, wherein dopants are introduced into the channel region.

66. A device for regulating the flow of electrical current, the device comprising:

a semiconductor substrate;

a gate electrode;

an electrically insulating layer located between the gate electrode and the semiconductor substrate, the insulating layer having a dielectric constant greater than 4.0; and

a source electrode and a drain electrode in contact with the semiconductor substrate and proximal to the gate electrode wherein at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate.

67. The device of claim 66, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

68. The device of claim 66, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

69. The device of claim 66, wherein the insulating layer is formed from a member of the group consisting of the metal oxides.

70. The device of claim 66, wherein the insulating layer is formed from an oxy-nitride stack.

71. The device of claim 66, wherein the Schottky contact or Schottky-like region is at least in areas adjacent to the channel.

72. The device of claim 66, wherein an entire interface between at least one of the source and the drain electrodes and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

73. The device of claim 66, wherein the channel region is doped.

74. The device of claim 66, wherein the insulating layer includes more than one layer.

75. The device of claim 67 or 68, wherein the insulating layer is formed from a member of the group consisting of metal oxides.

76. The device of claim 67 or 68, wherein the insulating layer is formed from an oxy-nitride stack.

77. The device of claim 75, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel, and wherein the channel region is doped.

78. The device of claim 76, wherein the Schottky contact or Schottky-like region is formed at least in areas adjacent to the channel, and wherein the channel region is doped.

79. A device for regulating the flow of electrical current, the device comprising:

a semiconductor substrate;

a gate electrode;

an electrically insulating layer located between the gate electrode and the semiconductor substrate, the insulating layer having a dielectric constant greater than 7.6; and

a source electrode and a drain electrode in contact with the semiconductor substrate and proximal to the gate electrode wherein at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate.

80. The device of claim 79, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

81. The device of claim 79, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

82. The device of claim 79, wherein the insulating layer is formed from a member of the group consisting of the metal oxides.

83. The device of claim 79, wherein the insulating layer is formed from an oxy-nitride stack.

84. The device of claim 79, wherein the Schottky contact or Schottky-like region is at least in areas adjacent to the channel.

85. The device of claim 79, wherein an entire interface between at least one of the source and the drain electrodes and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

86. The device of claim 79, wherein the channel region is doped.

87. The device of claim 79, wherein the insulating layer includes more than one layer.

88. A device for regulating the flow of electrical current, the device comprising:

a semiconductor substrate;

a gate electrode;

an electrically insulating layer located between the gate electrode and the semiconductor substrate, the insulating layer having a dielectric constant greater than 15; and

a source electrode and a drain electrode in contact with the semiconductor substrate and proximal to the gate electrode wherein at least one of the source electrode and the drain electrode forms a Schottky contact or Schottky-like region with the semiconductor substrate.

89. The device of claim 88, wherein the source and drain electrodes are formed from a member of the group consisting of: platinum silicide, palladium silicide and iridium silicide.

90. The device of claim 88, wherein the source and drain electrodes are formed from a member of the group consisting of the rare earth silicides.

91. The device of claim 88, wherein the insulating layer is formed from a member of the group consisting of the metal oxides.

92. The device of claim 88, wherein the insulating layer is formed from an oxy-nitride stack.

93. The device of claim 88, wherein the Schottky contact or Schottky-like region is at least in areas adjacent to the channel.

94. The device of claim 88, wherein an entire interface between at least one of the source and the drain electrodes and the semiconductor substrate forms a Schottky contact or Schottky-like region with the semiconductor substrate.

95. The device of claim 88, wherein the channel region is doped.

96. The device of claim 88, wherein the insulating layer includes more than one layer.